

# Solved Paper 2015

## BIOLOGY

Time : 3 Hours

Class-XII

Max. Marks : 70

### General Instructions :

- (i) There are a total of **30** questions and **four** sections in the question paper. **All** questions are compulsory.
- (ii) Section A contains question number **1** to **8**, very short answer type questions of **1** mark each.
- (iii) Section B contains question number **9** to **18**, short answer type-I questions of **2** marks each.
- (iv) Section C contains question number **19** to **27**, short answer type-II questions of **3** marks each.
- (v) Section D contains question number **28** to **30**, long answer type questions of **5** marks each .
- (vi) There is no overall choice in the question paper, however, an internal choice is provided in one question of **2** marks, **one** question of **3** marks and all the **three** questions of **5** marks. In these questions, an examinee is to attempt any **one** of the **two** given alternatives.

### Delhi Set I

Code No. 57/1/1

#### SECTION - A

*Q. Nos. 1 - 5 are of one mark each*

- 1. A geneticist interested in studying variations and patterns of inheritance in living beings prefers to choose organisms for experiments with shorter life cycle. Provide a reason.** 1

**Ans.** Many generations can be obtained (in a short time) // variations can be exhibited / selected faster. 1  
[CBSE Marking Scheme, 2015]

- 2. Name the transcriptionally active region of chromatin in a nucleus.** 1

**Ans.** Euchromatin / Exon. 1  
[CBSE Marking Scheme, 2015]

- 3. State a reason for the increased population of dark coloured moths coinciding with the loss of lichens (on tree barks) during industrialization period in England.** 1

**Ans.** Natural selection / survival of fittest / escaped predators due to camouflage. 1  
[CBSE Marking Scheme, 2015]

#### Detailed Answer:

During industrialisation period in England the lichens got wiped out due to air pollution and tree trunks became dark due to industrial smoke so that the dark colored moths could camouflage in the dark background without any risk of predation. Thus, they escaped predation, survived due to natural selection and therefore increased in population, whereas white winged moth did not survive due to predation and industrial pollution.

- 4. Indiscriminate diagnostic practices using X-rays etc., should be avoided. Give one reason.** 1

**Ans.** (Act as) Carcinogen / (harmful) mutation / chromosomal aberration / damage to DNA / normal cells converted to neoplastic. 1  
[CBSE Marking Scheme, 2015]

#### Detailed Answer:

Indiscriminate diagnostic practices using X-rays, gamma rays, etc. are ionizing radiations which usually produce breaks in the chromosomes and chromatids and abnormal mitosis in the irradiated cells. They cause abnormal functioning of the cells, mutations resulting in the development of various types of cancers especially blood cancer or leukaemia, etc.

- 5. What is Biopiracy ?** 1

**Ans.** Illegal / non-authorized / non-compensated use of bioresources by organisations (MNC) 1  
[CBSE Marking Scheme, 2015]

#### Detailed Answer:

Some organisations and multinational companies exploit or get patent for the biological resources of other nations without proper authorization from the concerned countries and this is called biopiracy.

#### SECTION - B

*Q. Nos. 6 - 10 are of two marks each*

- 6. After a brief medical examination a healthy couple came to know that both of them are unable to produce functional gametes and should look for an 'ART' (Assisted Reproductive Technique). Name the 'ART' and the procedure involved that you can suggest to them to help them bear a child.** 2

**Ans.** Test tube baby programme  $\frac{1}{2}$   
 Collection of ova and sperm from donor  $\frac{1}{2}$   
 (Corresponding procedure correctly explained)  $\frac{1}{2} + \frac{1}{2}$

**Explanation:**

**IVF:** Fertilisation outside the body in almost similar conditions as that in the body.

**ICSI:** Sperm is directly injected into the ovum.

**ET:** Embryo is transferred into reproductive tract / uterus.

**ZIFT:** Zygote or early embryos (upto eight blastomeres) transferred into fallopian tube.

**IUT:** Early embryos (with more than eight blastomeres) transferred into uterus.

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

Test-tube baby should be preferred in the case when both partners are unable to produce functional gametes. In this, the sperms from donor male and ova from donor female are induced to form a zygote in the laboratory (test-tube). Then zygote is allowed to divide forming 8 blastomeres. The zygote is transferred into the fallopian tube and then the normal developmental process goes on. It is also called ZIFT.

**7. Differentiate between male and female heterogamety. 2**

**Ans.**

	Male heterogamety	Female heterogamety
(i)	Male produces two types of gametes (while female produces only one type of gamete)	Female produces two types of gametes (while male produces only one type of gamete)
(ii)	XY / XO type // two types of heterogamety	ZW type // one type of heterogamety

**\* 8. How has mutation breeding helped in improving the production of mung bean crop ?**

**9. Mention a product of human welfare obtained with the help of each one of the following microbes: 2**

(a) LAB

(b) *Saccharomyces cerevisiae*

(c) *Propionibacterium sharmanii*

(d) *Aspergillus niger*.

**Ans. (a)** Milk to curd

(b) Bread / ethanol / alcoholic drinks / whiskey / brandy / beer / rum

(c) Swiss cheese

(d) Citric acid

**10. \* Many fresh water animals can not survive in marine environment. Explain. 2**

**OR**

**How are productivity, gross productivity, net primary productivity and secondary productivity interrelated ? 2**

**Ans.** Productivity is rate of biomass production  $\frac{1}{2}$   
 $GPP - R = NPP$   $1$   
 NPP - is biomass available to consumers for secondary productivity.  $\frac{1}{2}$   
 [CBSE Marking Scheme, 2015]

**Detailed Answer:**

$NPP = GPP - R$

NPP- Net Primary Productivity

GPP- Gross Primary Productivity

R - Respiration

Productivity is the rate of production of biomass at any trophic level at any given interval of time.

**Gross productivity:** It is the rate of production of organic matter by green plants per unit time per unit area. On the other hand we can say that it is the total amount of productivity.

**Net Primary Productivity:** It is the difference between gross primary productivity and the loss due to respiration.

**Secondary Productivity:** It is rate of production or formation of new organic matter by consumers especially the consumers of the first order or herbivores.

<b>SECTION - C</b>
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*Q. Nos. 11 - 22 are of three marks each*

**11. Double fertilisation is reported in plants of both, castor and groundnut. However, the mature seeds of groundnut are non-albuminous and castor are albuminous. Explain the post fertilization events that are responsible for it. 3**

**Ans.** Development of endosperm (preceding the embryo) takes place in both, developing embryo derives nutrition from endosperm.  $\frac{1}{2} + \frac{1}{2}$   
 Endosperm is retained / persists / not fully consumed in castor, endosperm is consumed in groundnut.  $1 + 1$

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

Endosperm development precedes embryo development. The triploid primary endosperm nucleus (PEN) undergoes repeated mitotic divisions, without cytokinesis. At this stage of development,

the endosperm is called free-nuclear endosperm. Cell wall formation takes place later on. As a result, the endosperm becomes partly or fully cellular. The cells of the endosperm store food materials, which are later used by the developing embryo.

In non-albuminous or non-endospermic seeds, the endosperm may be completely utilised by the developing embryo before the maturation of seeds e.g., pea, bean, groundnut, etc. In albuminous or endospermic seeds, a portion of endosperm persists in the mature seeds. e.g., castor.

**12. Describe the process of Parturition in humans. 3**

**Ans. (i)** Signals originate from the fully developed foetus and placenta,

**(ii)** Induce mild uterine contractions (foetal ejection reflex),

**(iii)** Triggers release of oxytocin (from maternal pituitary),

**(iv)** Oxytocin acts on uterine muscles and cause stronger uterine contractions,

**(v)** Stimulatory reflex between the uterine contraction and oxytocin secretion continues resulting in stronger and stronger contraction

**(vi)** Expel the baby from the uterus 1/2 x 6

**[CBSE Marking Scheme, 2015]**

**13. A teacher wants his/her students to find the genotype of pea plants bearing purple coloured flowers in their school garden. Name and explain the cross that will make it possible. 3**

**Ans. Test cross 1**

Purple flower to be crossed with white (homozygous recessive) flower **1**

If all flowers of F1 are purple then genotype is homozygous dominant / PP 1/2

If 50% are purple and 50% are white then genotype is heterozygous dominant / Pp 1/2

// (same thing can be shown with the help of crosses)

**[CBSE Marking Scheme, 2015]**

**Detailed Answer:**

The genotypes of a tall pea plant growing in school garden can be found by test cross.

A test cross is a cross between an organism with unknown genotype and a recessive parent. It is used to determine whether the individual is homozygous or heterozygous for a trait. For e.g., It is used to determine if tallness is coming from TT or Tt.

**Case I:** When TT is crossed with tt, we obtain all Tt (tall) individuals in the progeny.

**Case II:** When Tt is crossed with tt, we obtain all Tt (Tall) and tt (dwarf) individuals in the progeny.

Therefore, if tallness is coming from TT, then we obtain all tall progenies in test cross. We obtain both tall and dwarf varieties in test cross, if tallness is coming from Tt.

**14. (a) A DNA segment has a total of 1000 nucleotides, out of which 240 of them are adenine containing nucleotides. How many pyrimidine bases this DNA segment possesses ?**

**(b) Draw a diagrammatic sketch of a portion of DNA segment to support your answer. 3**

**Ans. (a)** Pyrimidine = 500 1/2

**(i)** Calculation

$$A = T, A = 240 \text{ hence } T = 240$$

So

$$A + T = 240 + 240 = 480$$

G = C,

$$G + C = 1000 - 480 = 520$$

So

$$C = \frac{520}{2} = 260$$

So

$$\begin{aligned} \text{pyrimidines} &= C + T \\ &= 260 + 240 = 500 \end{aligned}$$

**(ii)** Purine A and G always pair with T and C respectively

**(iii)**  $\frac{A}{G} = \frac{T}{C} = 1$  (Chargaff rule)

(b)

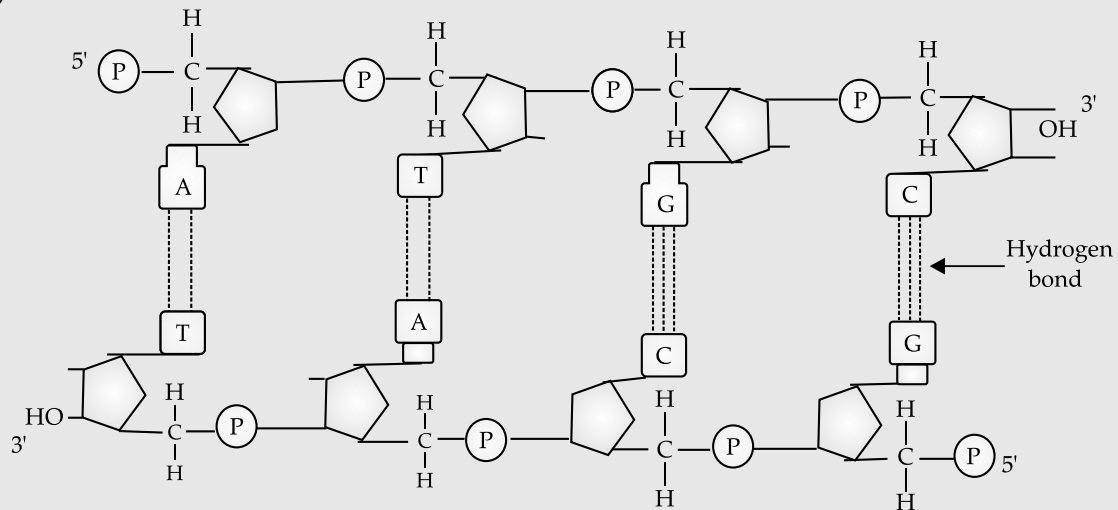


Diagram showing polarity

A-T

G-C

H-bond

½

½

½

½

[CBSE Marking Scheme, 2015]

15. Explain adaptive radiation with the help of a suitable example. 3

**Ans.** Evolution of different species in a given geographical area starting from a point and literally radiating to other geographical areas / habitat is called adaptive radiation. 1

A number of marsupials each different from other / Tasmanian wolf / Tiger Cat / Banded anteater / Marsupial rat / Kangaroo/ Wombat / Bandicoot / Koala / Marsupial mole / Sugar glider (any two or more), evolved from an ancestral stock, but all within Australian continent. 1

// Darwin's finches, from original seed eating features many other forms with altered beaks arose, enabling them to become insectivorous / vegetarian finches on the same (Galapagos) islands. 1

[CBSE Marking Scheme, 2015]

OR

The process of evolution that starts from a single point and radiates in different directions is called adaptive radiation. e.g., Australian marsupials have evolved from a single ancestor and placental mammals exhibit similarities with their corresponding marsupials such as placental wolves and Tasmanian wolves.

16. A team of students are preparing to participate in the interschool sports meet. During a practice session you find some vials with labels of certain cannabinoids. 3

(a) Will you report to the authorities? Why? 3

(b) Name a plant from which such chemicals are obtained. 3

(c) Write the effect of these chemicals on human body. 3

**Ans. (a)** Yes ½

May be abused by sports person ½

**(b)** *Cannabis sativa* / any other relevant plant 1**(c)** Effects cardiovascular system of the body 1

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

(a) Yes, I would report the matter to the authorities because vials might have been abused by the sports persons. Moreover, cannabinoids are classified under drugs and drug abuse is an illegal practice.

(b) Cannabinoids can be obtained from a plant called *Cannabis sativa*.

(c) These chemicals increase athletic performance of the sports persons but they have many harmful side effects. The cannabinoids bind to cannabinoid receptors present in the brain and affect the cardiovascular system.

\* 17. Enlist the steps involved in inbreeding of cattle. Suggest two disadvantages of this practice. 3

18. Choose any three microbes, from the following which are suited for organic farming which is in great demand these days for various reasons. Mention one application of each one chosen. 3

*Mycorrhiza; Monascus; Anabaena; Rhizobium; Methanobacterium; Trichoderma.*

**Ans.** (Fungal symbiont of the association) Absorb phosphorus from soil  
 Fix atmospheric nitrogen / Adds organic matter to the soil  
 Fix atmospheric nitrogen (in leguminous plants)  
 They digest cellulosic material and the product / spent slurry can be used as fertiliser  
**Trichoderma:** Biocontrol agent for several plant pathogens

(Any 3 microbes)

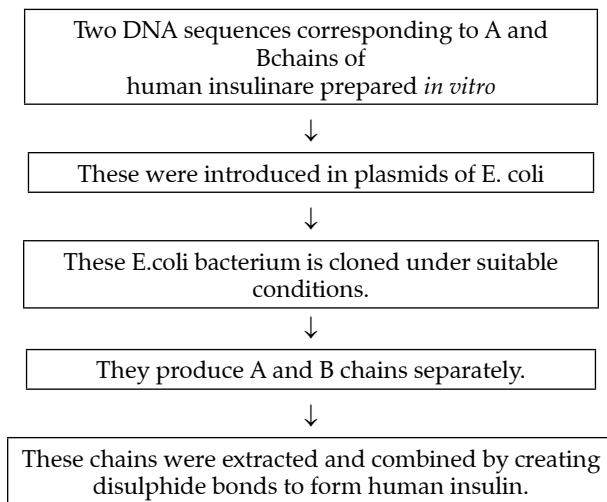
(Any 3 corresponding roles)

**19. Recombinant DNA-technology is of great importance in the field of medicine. With the help of a flow chart, show how this technology has been used in preparing genetically engineered human insulins.** 3

**Ans.** Insulin consists of two (short) polypeptide chains (A and B), linked by disulphide bonds, two DNA sequences corresponding to chain A and B prepared (by Eli Lilly company), introduced them into plasmids of *E. coli*, chain A and B produced separately, extracted and combined by creating disulphide bonds  $\frac{1}{2} \times 6$

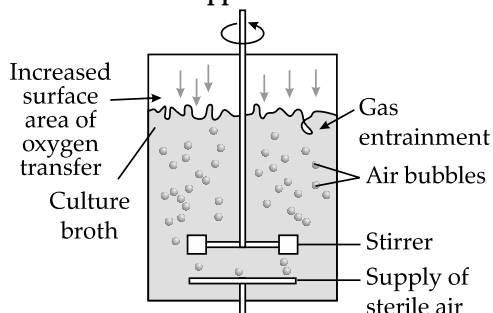
[CBSE Marking Scheme, 2015]

**Detailed Answer:**



**20. Draw a labelled sketch of sparged-stirred-tank bioreactor. Write its application.** 3

**Ans.**



Correct diagram

Any two correct labellings

Application = Produces larger biomass leading to higher yields of desired protein / recombinant protein / processing large volume of culture / conversion of raw materials into specific product biologically.

**21. Following the collision of two trains a large number of passengers are killed. A majority of them are beyond recognition. Authorities want to hand over the dead to their relatives.**

**Name a modern scientific method and write the procedure that would help in the identification of kinship.** 3

**Ans.** DNA fingerprinting (analysis)  $\frac{1}{2}$

- (i) Isolation and digestion of DNA by restriction endonuclease.
- (ii) Separation of DNA fragments by electrophoresis and transferring them to synthetic membranes / nitrocellulose / nylon.
- (iii) Hybridisation using labelled VNTR probe.
- (iv) Detection of hybridised DNA fragments by autoradiography.
- (v) Matching banding pattern of DNA / DNA fingerprints / autoradiograms of the passengers killed and that of relatives.  $\frac{1}{2} \times 5$

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

DNA fingerprinting is the technique of determination of nucleotide sequence of certain areas of DNA, which are unique to each individual.

**Step/Procedure in DNA Fingerprinting:**

- (i) **Extraction of DNA:** using high speed refrigerated centrifuge.
- (ii) **Amplification:** many copies are made using PCR.
- (iii) **Restriction Digestion:** using restriction enzymes DNA is cut into fragments.
- (iv) **Separation of DNA fragments:** using electrophoresis agarose polymer gel.
- (v) **Southern Blotting:** Separated DNA sequences are transferred to nitrocellulose or nylon membranes.
- (vi) **Hybridization:** The nylon membranes exposed to radioactive probes.
- (vii) **Autoradiography:** The dark bands develop at the probe site.
- (viii) Matching the banding pattern so obtained with that of relative.

**22. Many plant and animal species are on the verge of their extinction because of loss of forest land by indiscriminate use by the humans. As a biology student what method would you suggest along with its advantages that can protect such threatened species from getting extinct?** 3

OR

- \* "Determination of Biological Oxygen Demand (BOD) can help in suggesting the quality of a water body." Explain.

Ans. Ex-situ conservation	1
Threatened animals and plants are taken out from their natural habitat and placed in special setting where they can be protected and given special care.	1
Botanical garden / tissue culture / micro propagation / seed bank.	½
Zoological park / wild life safari park / cryopreservation.	½
[CBSE Marking Scheme, 2015]	

Detailed Answer:

As a biology student, I would suggest the following method that can protect these threatened species from becoming extinct.

**Ex situ conservation:** The threatened species of plants and animals are taken out of their habitats and are kept in special setting such as zoological parts, botanical gardens and wildlife sanctuaries.

In the present scenario, the gametes of endangered species can be preserved by methods like cryopreservation and can be fertilised in vitro followed by propagation through tissue culture methods. Similarly, seeds can be preserved in seed banks. This type of conservation method is an off-site conservation method.

### SECTION - D

*Q. Nos. 23 is of four marks*

- \* 23. Since October 02, 2014 "Swachh Bharat Abhiyan" has been launched in our country.

- (a) Write your views on this initiative giving justification.
- (b) As a biologist name two problems that you may face while implementing the programme in your locality.
- (c) Suggest two remedial methods to overcome these problems. 4

### SECTION - E

*Q. Nos. 24 - 26 are of five marks each*

24. A flower of tomato plant following the process of sexual reproduction produces 240 viable seeds.

Answer the following questions giving reasons:

- (a) What is the minimum number of pollen grains that must have been involved in the pollination of its pistil ?

- (b) What would have been the minimum number of ovules present in the ovary ?

- (c) How many megaspore mother cells were involved ?

- (d) What is the minimum number of microspore mother cells involved in the above case ?

- (e) How many male gametes were involved in this case ? 5

OR

During the reproductive cycle of a human female, when, where and how does a placenta develop?

What is the function of placenta during pregnancy and embryo development ? 5

Ans. (a) 240, one pollen grain participates in fertilisation of one ovule. ½+½

(b) 240, one ovule after fertilisation forms one seed. ½+½

(c) 240, each MMC forms four megaspores out of which only one remain functional. ½+½

(d) 60, each microspore mother cell meiotically divides to form four pollen grains ( $240/4 = 60$ ) ½+½

(e) 480, each pollen grain carries two male gametes (which participate in double fertilisation) ( $240 \times 2 = 480$ ) ½+½

OR

After implantation, uterus, chorionic villi and uterine tissue become interdigitated (physically fused) 1+1+1

Placenta facilitates supply of oxygen / nutrients to the embryo. ½

Removal of carbon dioxide / waste material / excretory material produced by the embryo. ½

Production of hCG / hPL / estrogens / progestogens

(Any two) ½×2

[CBSE Marking Scheme, 2015]

Detailed Answer:

After implantation, the cells of the inner cell mass of the blastocyst differentiate to form the embryo. The trophoblast differentiates into two layers, the outer layer secretes enzymes to dissolve the endometrium of the uterus. The inner layer grows out as finger-like projections called chorionic villi into the uterine stroma. They are surrounded by the uterine tissue and maternal blood vessels. The chorionic villi and uterine tissue become interdigitated to form the structural-functional unit called placenta.

The placenta secretes hormones like human chorionic gonadotropin (hCG), human placental

lactogen (hPL), estrogens and progesterone that are necessary to maintain pregnancy.  
Placenta also facilitates the supply of oxygen and provides nutrients to the embryo through the umbilical cord.

**25. Explain the genetic basis of blood grouping in human population.** 5

OR

**How did Hershey and Chase established that DNA is transferred from virus to bacteria ?** 5

**Ans. (i)** Blood group in human population determined by gene 'I', which has three allele I<sup>A</sup> and I<sup>B</sup> and i (multiple allelism) ½+½

**(ii)** I<sup>A</sup> I<sup>B</sup> are dominant allele (codominance) each forming different type of sugar polymer on the surface of RBC, while allele 'i' is recessive and does not produce any sugar ½+½

I<sup>A</sup> I<sup>A</sup>, I<sup>A</sup> i — A group ½

I<sup>B</sup> I<sup>B</sup>, I<sup>B</sup> i — B group ½

I<sup>A</sup> I<sup>B</sup> — AB group ½

i i — O group ½

**(iii)** Since humans are diploid / each person possesses any two of three 'I' gene alleles, resulting into six different genotypic combination and four phenotypic expression ½ + ½

OR

- Some bacteriophage were grown in a medium that contained 32P / radioactive phosphorus, while some were grown in a medium that contained 35S / radioactive sulphur ½×2

- The labelled bacteriophage from both media were allowed to infect E. coli 1

- In both the cases viral coats were removed from the bacteria by agitating them in a blender 1

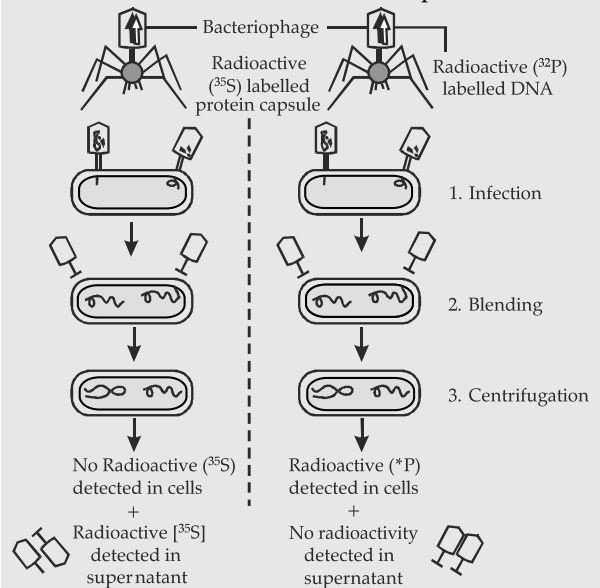
- The virus particles were separated from the bacteria by spinning them in a centrifuge 1

- No radioactivity was detected in cells (E. coli) but detected in supernatant in case where bacteriophage were labelled with radioactive sulphur ½

- Radioactivity detected in cells (E. coli) while no radioactivity detected in supernatant in another case where bacteriophage were labelled with radioactive phosphorus ½

(Phosphorus being a constituent of DNA indicates that DNA is the genetic material that is passed from virus to bacteria)

The following diagrammatic representation can be considered in lieu of the above explanation.



[CBSE Marking Scheme, 2015]

**26. "Analysis of age-pyramids for human population can provide important inputs for long-term planning strategies." Explain.** 5

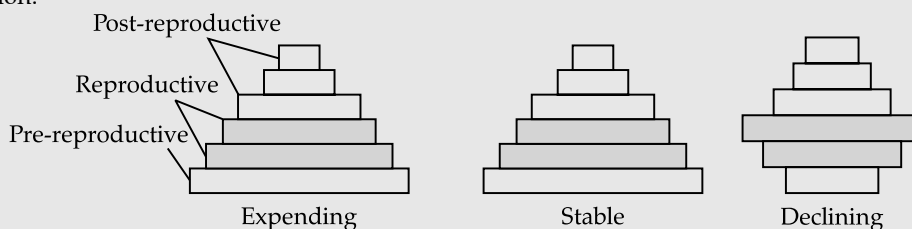
OR

**Describe the advantages for keeping the ecosystems healthy.** 5

**Ans.** Age pyramids show age distribution of males and females in a combined diagram. ½

The shape of the pyramid reflects the growth status of the population whether it is growing or stable or declining. ½

Pyramids also indicate the ratio of pre-reproductive, reproductive and post reproductive individuals in a population. ½



Planing of health / education / transport / infra-structure / finance / food / employment can depend on the age-pyramid analysis of a population / any other relevant point.

(Any two with proper explanation) 1+1

OR

- (i) Purify air / purify water
- (ii) Mitigates drought / mitigates flood
- (iii) Cycle nutrients
- (iv) Generate fertile soil
- (v) Provide wildlife habitat
- (vi) Maintain biodiversity
- (vii) Pollinate crop
- (viii) Provide storage site for carbon
- (ix) Provide aesthetic value / provide cultural value / provide spiritual value
- (x) Provide stable food chain
- (xi) Provide economically useful forest produces
- (xii) Provide sustainable biological legacy to future generations

(Description of any five advantages) 1×5

Detailed Answer:

**Analysis of age-pyramids for human population can provide important inputs for long-term planning strategies:** The different age groups present in a population determines its reproductive status. Distribution of age groups highly influences the growth of the population. Each population displays following three ecological ages or age groups

- (a) Pre-reproductive
- (b) Reproductive
- (c) Post-reproductive.

Population having a large number of young members grows rapidly, while the population

bearing more number of post-reproduction members tends to be declining. There are basically three types of age-pyramids found to be present in the human population. These are as follows :

**Refer figures given above in CBSE Marking Scheme.**

Therefore, through the analysis of the age-pyramids of a particular population, the distribution of resources can be done more efficiently. A better planning strategy can be adopted considering the demand of the resource, thus, long term management of resources can be done in such a way that the population can derive maximum benefit with minimum effects on nature, leading the population to flourish efficiently.

Delhi Set II

Code No. 57/1/2

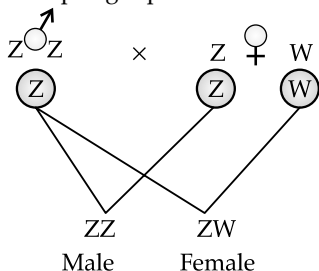
Note : Except for the following questions, all the remaining questions have been asked in previous set.

SECTION - B

\* 7. Name any two common Indian millet crops. State one characteristic of millets that has been improved as a result of hybrid breeding so as to produce high yielding millet crops. 2

9. Explain mechanism of sex-determination in birds. 2

Ans. Females have one Z sex chromosome and one W sex chromosome, males have a pair of Z sex chromosome, if Z sperm fertilises Z ovum a male offspring is produced, if Z sperm fertilises W ovum a female offspring is produced.



SECTION - C

11. What is adaptive radiation ? When can adaptive radiation be referred to as convergent evolution ? Give an example. 3

Ans. **Adaptive Radiation:** The process of evolution of different species in a given geographical area starting from a point and literally radiating to other geographical areas (habitats).

When more than one adaptive radiation appeared to have occurred in an isolated geographical area (representing different habitats), then this can be referred to as convergent evolution.

Example:

Placental mammals	Australian marsupials
Wolf	Tasmanian wolf
Mole	Marsupial mole
Anteater	Numbat (anteater)
Mouse	Marsupial mouse
Lemur	Spotted cuscus
Flying squirrel	Flying phalanger
Bobcat	Tasmanian tiger cat

Any one pair of example.



13. (a) A DNA segment has a total of 1,500 nucleotides, out of which 410 are Guanine containing nucleotides. How many pyrimidine bases this segment possesses ?

(b) Draw a diagrammatic sketch of a portion of DNA segment to support your answer.

3

Ans. (a) 750

1/2

(i) Calculation

$$G = C, G = 410 \text{ hence } C = 410$$

$$G + C = 410 + 410 = 820$$

so

$$A + T = 1500 - 820 = 680$$

$A = T$ ,

so

$$T = \frac{680}{2} = 340$$

so

$$\begin{aligned} \text{pyrimidines} &= C + T \\ &= 410 + 340 = 750 \end{aligned}$$

(ii) Purine A and G always pair with T and C respectively

(iii)  $\frac{A}{G} = \frac{T}{C} = 1$  (Chargaff rule)

1/2

(b)

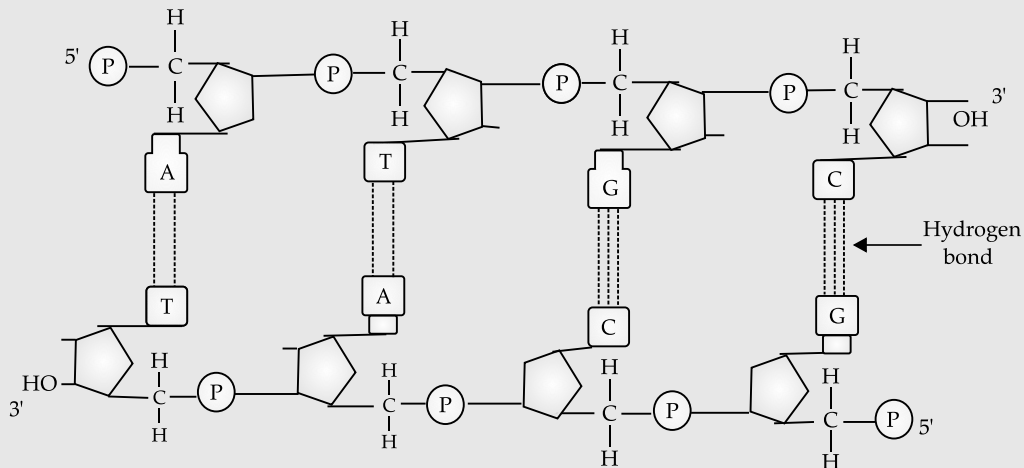


Diagram showing polarity

A-T

G-C

H-bond

1/2

1/2

1/2

1/2

[CBSE Marking Scheme, 2015]

14. Name the stage of human embryo at which it gets implanted. Explain the process of implantation. 3

Ans. Blastocyst

The trophoblast layer of the blastocyst get attached to the endometrium and the inner cell mass gets differentiated as the embryo, after attachment the uterine cell, divide rapidly and covers the blastocyst, as a result the blastocyst become embedded in the endometrium of the uterus.

15. A non biology person is quite shocked to know that apple is a false fruit, mango is a true fruit and banana is a seedless fruit. As a biology student how would you satisfy this person ? 3

Ans. Apple: Thalamus (along with ovary) contribute to fruit 1

Mango: Develops only from the ovary 1

Banana: Develops from ovary but without fertilization / Parthenocarpy 1

[CBSE Marking Scheme, 2015]

Detailed Answer:

The fruit is a ripened ovary where as seed develops from the ovule. Mango is a true fruit because it develops only from the ovary of the flower. Apple is a false fruit because here in this case along with the ovary thalamus of the flower also takes part in the formation of fruit. Banana is a seedless fruit as it develops without the stimulus of pollination and fertilisation. Such fruits are also called as parthenocarpic fruits.

**SECTION - E**

25. A flower of brinjal plant following the process of sexual reproduction produces 360 viable seeds.

Answer the following questions giving reasons:

- (a) How many ovules are minimally involved ?
- (b) How many megaspore mother cells are involved ?
- (c) What is the minimum number of pollen grains that must land on stigma for pollination ?

(d) How many male gametes are involved in the above case ?

(e) How many microspore mother cells must have undergone reduction division prior to dehiscence of anther in the above case ? 5

**OR**

Describe the changes that occur in ovaries and uterus in human female during the reproductive cycle. 5

Ans. (a) 360, one ovule after fertilisation forms one seed. 1/2+1/2

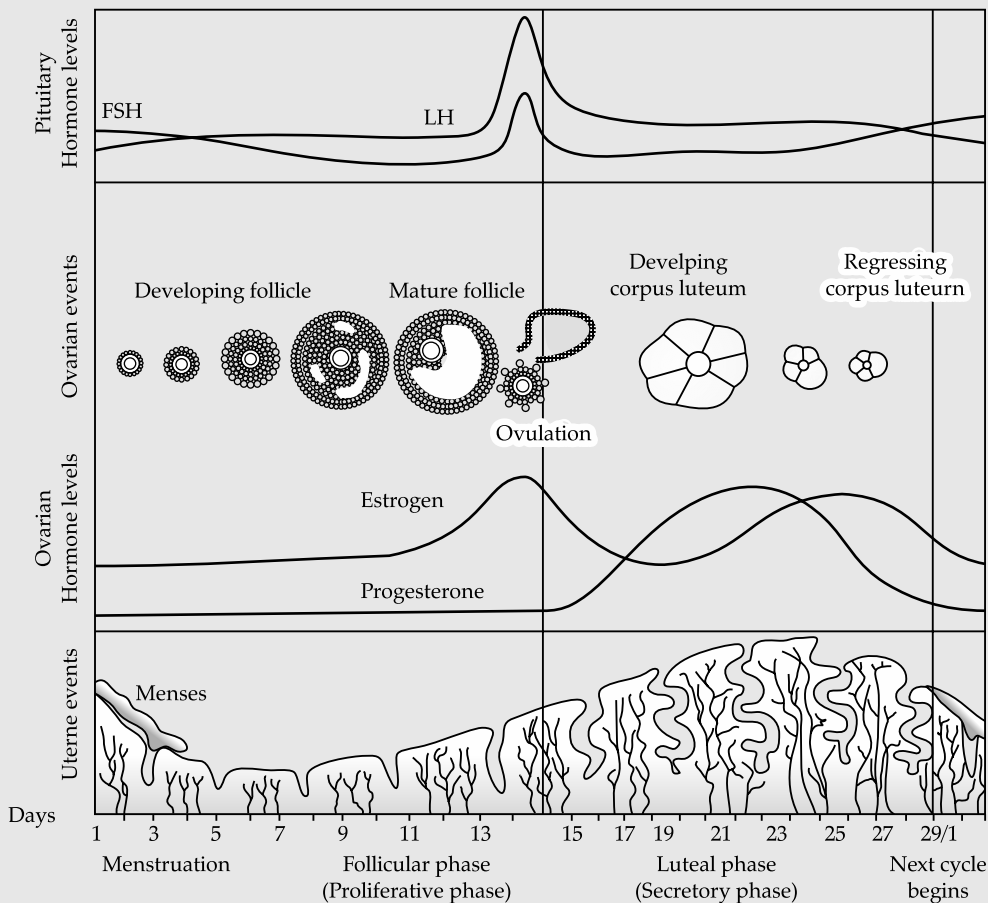
(b) 360, each MMC forms four megaspores out of which only one remains functional 1/2+1/2

(c) 360, one pollen grain participates in fertilisation of one ovule 1/2+1/2

(d) 720, each pollen grain carries two male gametes (which participate in double fertilisation)  $(360 \times 2 = 720)$  1/2+1/2

(e) 90, each microspore mother cell meiotically divides to form four pollen grains  $(360 / 4 = 90)$  1/2+1/2

**OR**



Same value points described in an explanation

1/2 x 10

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

Menstrual cycle is the reproductive cycle that begins at puberty (menarche).

In human females, menstruation occurs once in 28 to 29 days. The cycle of events starting from one menstruation till the next one is called the menstrual

cycle. During the middle of the menstrual cycle, one ovum is released (ovulation). The cycle starts with the menstrual flow (3 to 5 days), caused due to the breakdown of the endometrium of the uterus.

Blood vessels in liquid state are discharged, but this occurs only when the ovum is not fertilised.

It is followed by the follicular phase where the primary follicles mature into Graafian follicles.

This causes the regeneration of the endometrium. These changes are brought about by ovarian and pituitary hormones. In this phase, the release of gonadotropins (LH and FSH) increases. This causes follicular growth and the growing follicles produce oestrogen. The LH and FSH are at their peak in the middle of the cycle (14th day) and cause the rupture of the Graafian follicles to release ovum.

This phase is called the ovulatory phase. The remains of the Graafian follicles get converted into the corpus luteum, which secretes progesterone for the maintenance of the endometrium. In the absence of fertilisation, the corpus luteum degenerates, thereby causing the disintegration of the endometrium and the start of a new cycle.

[Refer diagram given above in CBSE Marking Scheme]

### Delhi Set III

Code No. 57/1/3

**Note:** Except for the following questions, all the remaining questions have been asked in previous set.

/ IUT / Intra uterine insemination - Early embryos (with more than eight blastomeres) transferred into uterus 1

[CBSE Marking Scheme, 2015]

### SECTION - B

**6. Differentiate between 'ZZ' and 'XY' type of sex-determination mechanisms. 2**

**Ans.** ZZ - males (birds) homogametic (females heterogametic), sex is determined by the type of egg getting fertilised  $\frac{1}{2} + \frac{1}{2}$   
XY male (human being) heterogametic (females homogametic), sex is determined by the type of sperm fertilising the ovum  $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

ZZ type of sex determination mechanism is found in birds. In this type, the females have heteromorphic sex chromosomes (ZW), while males have homomorphic sex-chromosomes (ZZ). Females are heterogametic i.e., produce two dissimilar types of eggs while males produce only one type of sperms. The egg determines the sex of the individual.

XY type of sex determination mechanism is found in human beings. In this type, the male individuals have heteromorphic sex chromosomes (XY) and are therefore heterogametic i.e., producing two types of sperms are with X and the other carrying the Y chromosome. The females have homomorphic sex chromosome (XX) and homogametic i.e., produce only one type of eggs. The sex of the offspring is determined by the type of sperm taking part in fertilization.

**7. An infertile couple is advised to adopt test-tube baby programme. Describe two principle procedures adopted for such technologies. 2**

**Ans.** IVF / In vitro fertilisation - Fertilisation outside the body in almost similar conditions as that in the body / ICSI / Intra cytoplasmic sperm injection- A sperm is directly injected in to the ovum. 1

ET / Embryo transfer - Embryo is transferred into reproductive tract or uterus / ZIFT / Zygote intra fallopian transfer - Zygote or early embryos (upto eight blastomeres) transferred into fallopian tube

**Detailed Answer :**

The test-tube baby programme involves mainly following two principal procedures:

(i) **In-vitro fertilisation (IVF):** It is the fertilisation outside the body conditions almost similar to those which exist in the body. The ova and sperms from the donor parents are taken and fused to form the zygote in the laboratory outside the body of the female. Then the zygote is transferred into the fallopian tube.

(ii) **Embryo transfer (ET):** The embryo is transferred into the reproductive tract. The zygote is allowed to divide to form about 8-blastomeres. The zygote or the embryo in the early stage of development is transferred into the fallopian tube by Zygote Intra Fallopian Transfer (ZIFT) technique. If the embryo is in a bit later stage having about 8 blastomeres it is transferred into the uterus by intra uterine transfer (IUT) of the infertile female partner or into that of surrogate mother for giving birth to the baby.

**9. Enumerate four objectives for improving the nutritional quality of different crops for the health benefits of the human population by the process of "Biofortification". 2**

### SECTION - C

**12. Describe the development of endosperm after double fertilization in an angiosperm. Why does endosperm development precedes that of zygote ? 3**

**Ans.** Following fertilisation the PEN (primary endosperm nucleus) divides repeatedly to give rise to free nuclei, subsequent cell wall formation leading to formation of endosperm. 1+1

Cells of endosperm are filled with reserved food materials to be used for nutrition of the developing embryo / for providing food to the developing embryo. 1

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

- (i) After triple fusion, the central cell develops into a primary endosperm cell which contain triploid primary endosperm nucleus (PEN).
- (ii) The primary endosperm cell undergoes successive cell divisions to form triploid endosperm which has abundant food reserves.
- (iii) The primary endosperm nucleus undergoes successive nuclear divisions to form many free nuclei. This type of endosperm development is called free nuclear endosperm, after which cell walls are laid and the endosperm becomes cellular endosperm. e.g., coconut water is nuclear endosperm (containing many free nuclei). While white kernel around is the cellular endosperm. The endosperm development precedes that of zygote to ensure that endosperm containing abundant food reserves is formed earlier and can nourish the developing embryo.

**13. Explain the interpretation of Charles Darwin when he observed a variety of small black birds on Galapagos Islands.** 3

**Ans.** Darwin conjectured that all varieties are evolved on the Galapagos island itself, from original seed eating features, many other forms with altered beaks arose, became insectivorous, and vegetarian finches, adaptive radiation.  $\frac{1}{2} \times 6$

**[CBSE Marking Scheme, 2015]**

**Detailed Answer:**

Charles Darwin observed a variety of small black birds called finches. By observing their characteristics on the Galapagos islands, he proposed his famous theory known as the 'theory of natural selection'.

**The main postulates of this theory are as follows:**

- (i) All organisms possess an enormous power of fertility.
- (ii) Food, space and resources are limited.
- (iii) There is a struggle for the existence within a species as well as between two different species.
- (iv) Nature will favour the survival of the fittest.
- (v) No two individuals will be exactly identical except identical twins. Some variations will always exist.
- Darwin believed that variations will ultimately lead to the formation of new species.

**15. (a) A DNA segment has a total of 2,000 nucleotides, out of which 520 are adenine containing nucleotides. How many purine bases this DNA segment possesses ?**

**(b) Draw a diagrammatic sketch of a portion of DNA segment to support your answer.** 3

**Ans. (a)** 1000 purines  $\frac{1}{2}$

(i) Calculation

$$A = T, A = 520 \text{ hence } T = 520$$

$$A + T = 520 + 520 = 1040$$

$$\text{so } G + C = 2000 - 1040 = 960$$

$$G = C,$$

$$\text{so } C = \frac{960}{2} = 480$$

$$\text{so } \text{pyrimidines} = C + T \\ = 480 + 520 = 1000$$

(ii) Purine A and G always pair with T and C respectively

(iii)  $\frac{A}{G} = \frac{T}{C} = 1$  (Chargaff rule)  $\frac{1}{2}$

(b)

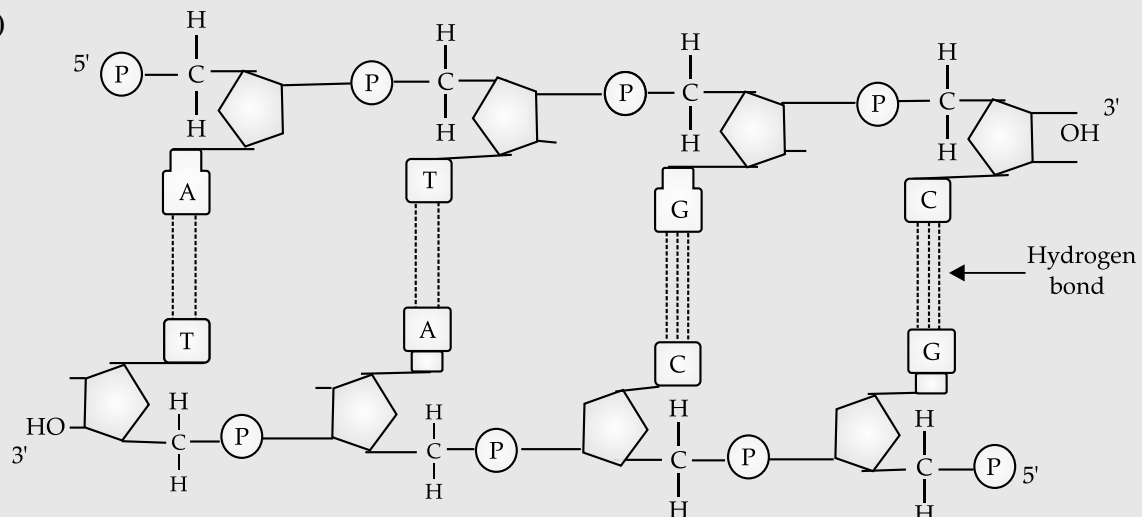


Diagram showing polarity  
 N- base  
 H - bond  
 Deoxyribose sugar

1/2  
 1/2  
 1/2  
 1/2

[CBSE Marking Scheme, 2015]

**SECTION - E**

26. A flower of tomato plant following the process of sexual reproduction produces 200 viable seeds.

Answer the following questions giving reasons:

- (a) What would have been the minimum number of ovules present in pre-pollinated pistil ?
- (b) How many microspore mother cells would minimally be required to produce requisite number of pollen grains ?
- (c) How many pollen grains must have minimally pollinated the carpel ?
- (d) How many male gametes would have used to produce these 200 viable seeds ?
- (e) How many megaspore mother cells were required in this process ?

5

OR

Explain the development of a secondary oocyte (ovum) in a human female from the embryonic stage upto its ovulation. Name the hormones involved in this process.

5

Ans. (a) 200, one ovule after fertilisation forms one seed.

1/2+1/2

(b) 50, each microspore mother cell meiotically divides to form four pollen grains  $\left(\frac{200}{4} = 50\right)$

1/2+1/2

(c) 200, one pollen grain participates in fertilisation of one ovule.

1/2+1/2

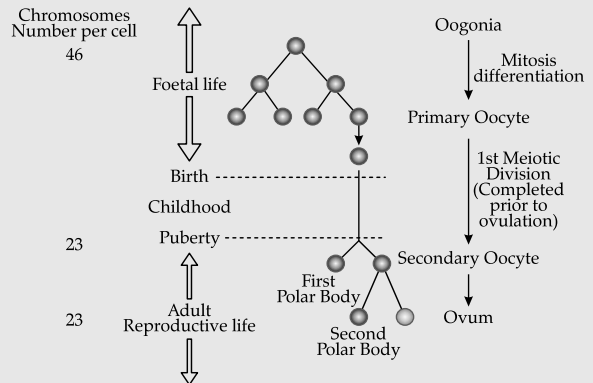
(d) 400, each pollen grain carries two male gametes which (participate in double fertilisation)  $(200 \times 2 = 400)$ .

1/2+1/2

(e) 200, each MMC forms four megaspores out of which only one remains functional.

1/2+1/2

OR



Hormones:

- LH / Luteinising hormone 1/2
- FSH / Follicle stimulating hormone 1/2
- Estrogen 1/2

[CBSE Marking Scheme, 2015]

**Outside Delhi Set I**

**Code No. 57/1**

**SECTION - A**

Q. Nos. 1 - 5 are of one mark each

1. How many chromosomes do drones of honeybee possess? Name the type of cell division involved in the production of sperms by them.

1

Ans. 16, Mitosis

2. What is a cistron ?

1

Ans. A segment of DNA, Coding for a polypeptide.

3. Retroviruses have no DNA. However, the DNA of the infected host cell does possess viral DNA. How is it possible?

1

Ans. Reverse transcription of viral RNA into viral DNA, then integrates/ incorporates with the host DNA.

1/2+1/2

[CBSE Marking Scheme, 2015]

Detailed Answer:

RNA is the genetic material in retrovirus. This RNA forms DNA by the process of reverse transcription

with the help of the enzyme called reverse-transcriptase.

4. Why do children cured by enzyme-replacement therapy for adenosine deaminase deficiency need periodic treatment ?

1

Ans. As this therapy does not cure the disease completely.

1

[CBSE Marking Scheme, 2015]

Detailed Answer:

In enzyme replacement therapy, lymphocytes isolated from the child's blood are cultured in-vitro. A functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes, which are subsequently returned to the child. However, as these cells are not immortal, so the child requires a periodic infusion of such genetically engineered lymphocytes.

\* 5. List two advantages of the use of unleaded petrol in automobiles as fuel.

1

**SECTION - B***Q Nos. 6-10 are of two marks each*

- \* 6. Why do moss plant produce very large number of male gametes? Provide one reason. What are these gametes called? 2
7. (a) Select the homologous structure from the combinations given below: 2
- (i) Forelimbs of whales and bats  
(ii) Tuber of potato and sweet potato  
(iii) Eyes of octopus and mammals  
(iv) Thorns of Bougainvillea and tendrils of Cucurbita
- (b) State the kind of evolution they represent.

Ans. (a) (i) Forelimbs of whales and bats. ½  
(iv) Thorns of Bougainvillea and tendrils of Cucurbita. ½  
(b) Divergent Evolution 1  
[CBSE Marking Scheme, 2015]

**Detailed Answer:**

(b) Homology is based on divergent evolution. It indicates the common ancestry. The homologous organs, though perform different functions but have the same fundamental structure. During development these organs follow the same basic plan of organisation but however in adult condition they get modified to perform different function in response to adaptation according to different environmental conditions e.g., the forelimbs of man, whale and bat. They have same structural plan but have different functions.

- \* 8. (a) Why are the plants raised through micropropagation termed as somaclones? 2

(b) Mention two advantages of this technique. 2

9. Explain the different steps involved during primary treatment phase of sewage. 2

Ans. Physical removal of particles (large and small), by filtration and sedimentation, forming primary sludge/sedimented solids, forming effluent (supernatant) for secondary treatment. ½×4=2

10. What is mutualism? Mention any two examples where the organisms involved are commercially exploited in agriculture. 2

OR

List any four techniques where the principle of ex-situ conservation of biodiversity has been employed. 2

Ans. Interaction between two species in which both are benefitted. 1  
(i) *Rhizobium* in the roots (nodules) of legumes. ½  
(ii) *Mycorrhiza* / *Glomus* with the roots of higher plants. ½

OR

Cryopreservation, in vitro fertilisation, micro propagation / tissue culture, sperm bank/ seed bank / gene bank. ½×4=2

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

Mycorrhiza is an association between fungi and the roots of higher plants. It is an example of mutualism in which both fungi and plants are dependent on each other for nutritional needs. The fungi help the plant in the absorption of essential nutrients from the soil while the plant provides the fungi with carbohydrates. The interaction that exists between cattle egret and cattle is known as commensalism. In this type of interaction, one species is benefitted whereas the other is neither benefitted nor harmed. The cattle egret (bird) usually forages near the grazing cattle. As cattle moves in the grass they stir up the grass and flush out the insects which then become an easy target for the egret. In this way, the cattle are neither benefitted nor harmed but the egret is benefitted.

OR

Four techniques where the principle of ex situ conservation of biodiversity has been employed are as follows:

- (i) Preservation of the gametes of threatened species (using cryopreservation technique) in viable and fertile condition for long periods.  
(ii) In vitro fertilization of eggs.  
(iii) Propagation of plants using tissue culture technique.  
(iv) Keeping the seeds of different genetic strains that are commercially important plants for long period in seed bankers.

**SECTION - C***Q Nos. 11-22 are of three marks each*

11. State what is apomixis. Comment on its significance. How can it be commercially used? 3

Ans. Form of asexual reproduction producing seeds without fertilisation/type of asexual reproduction that mimics sexual reproduction to form seeds without fertilisation. 1

Parental characters are maintained in the progeny/offspring (as there is no meiosis/ segregation of characters). 1

If desired hybrid seeds are made apomictics the farmers can keep on using the hybrid seeds to raise new crops year after year. 1

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

The of substitution of sexual process by asexual methods in plants is called apomixis. Hence, apomixis is a form of asexual reproduction that mimics sexual reproduction. In apomixis seeds are formed without the fusion of gametes. Diploid cells of the nucellus or integuments develop into an embryo, giving diploid seeds with a genetic constitution identical to the parent.

**Commercial use of apomixis:** The method of producing hybrid seeds by cultivation is very

expensive for farmers. Also, by sowing hybrid seeds, it is difficult to maintain hybrid characters as characters segregate during meiosis. Apomixis thus prevents the loss of specific characters into hybrid. If hybrids with desirable characteristics can be made into apomict, there is no segregation of characters in the hybrid progeny and farmer can continue using hybrid seeds year after year and without buying new seeds. Also, it is cost-effective method for producing seeds.

12. During a monohybrid cross involving a tall pea plant with a dwarf pea plant, the offspring populations were tall and dwarf in equal ratio. Work out a cross to show how it is possible. 3

**Ans.**

Parent	(Tall)	x	(Dwarf)	= 1
	Tt		tt	
Gametes	(T)	(t)	(t)	(t) = 1
F <sub>1</sub> Generation	Tt	Tt	tt	tt = 1/2 (genotype)
	Tall		Dwarf	= 1/2 (genotype)
	1		1	

*Note: (Similar cross shown in a Punnett square to be accepted)*

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

[Refer the cross given above in CBSE Marking Scheme]

The asked scenario is possible only when the tall pea plant is heterozygous and the dwarf pea plant is homozygous.

In this case, the progeny would be 50% tall and 50% dwarf.

13. Explain the significance of satellite DNA in DNA fingerprinting technique. 3

**Ans. (i)** They do not code for any proteins.

**(ii)** They form large part of the human genome.

**(iii)** They show high degree of polymorphism / Specific to each individual.

**Detailed Answer:**

Satellites DNA are short sequences of DNA repeated again and again to form long sequences, means that a single sequence is repeated many times over. They are divided into mini-satellites and micro-satellites whose characteristic makes them simple for identification between two samples as the DNA is polymorphic. Since DNA from every tissue of an individual shows the same degree of polymorphism, it forms the basis of DNA fingerprinting. The polymorphism is also inherited by children from the parents, hence it helps in paternity testing in dispute cases.

14. What does the following equation represent ? Explain.

$$p^2 + 2pq + q^2 = 1$$

3

**Ans.** Hardy Weinberg's Principle / allele frequencies in a population are stable and is constant from generation to generation, 1 represents stable allelic frequency in a population, indicating no evolution occurring,  $p^2$  frequency of homozygous dominant / AA,  $2pq$  frequency of heterozygous / Aa,  $q^2$  frequency of homozygous recessive / aa =  $\frac{1}{2} \times 6$

**Note:** (if AA, Aa, aa have been indicated using any other alphabet correctly can be accepted)

[CBSE Marking Scheme, 2015]

15. A heavily bleeding and bruised road accident victim was brought to a nursing home. The doctor immediately gave him an injection to protect him against a deadly disease. 3

- (a) Write what did the doctor inject into the patient's body.  
 (b) How do you think this injection would protect the patient against the disease ?  
 (c) Name the disease against which this injection was given and the kind of immunity it provides.

**Ans. (a)** Tetanus antitoxins/Tetanus toxoid. 1

**(b)** The preformed antibody injected, act on the pathogen immediately to provide protection.  $\frac{1}{2} \times 2 = 1$

**(c)** Tetanus, passive immunity.  $\frac{1}{2} \times 2 = 1$

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

- (a) In a patient's body, the doctor has injected antiserum containing preformed antibodies against the causative organisms or toxin produced by it.  
 (b) The solution injected by the doctor had antibodies. Hence, the infection would protect the patient against the diseases and provide him humoral immunity.  
 (c) The disease against which this injection was given is tetanus caused by Clostridium tetani, which usually exists in environment as spores and may gain access to the body through wound.

The kind of immunity that the infection containing antiserum provides is passive immunity. In this, preformed antibodies are used because fast action is required in this emergency case.

- \* 16. Enumerate any six essentials of good, effective Dairy Farm Management Practices. 3

17. State the medicinal value and the bioactive molecule produced by Streptococcus, Monascus and Trichoderma. 3

OR

What are methanogens? How do they help to generate biogas? 3

**Ans.** Streptococcus; Streptokinase, clot buster / remove clot from the blood vessels. 1  
 Monascus; Statin, blood cholesterol lowering agent / it inhibits the enzymes responsible for synthesis of cholesterol. 1  
 Trichoderma; cyclosporin A, immunosuppressive agents used in organ transplantation. 1

OR

Anaerobic, methane producing bacteria  $\frac{1}{2} \times 2$   
 methanogens generate biogas, when act on cellulose rich biowaste (anaerobically) 1+1

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

**Streptococcus:** It produces Streptokinase enzyme that is used to dissolve clots formed in the blood vessels.

**Monascus:** It produces statins that help in lowering blood Cholesterol levels.

**Trichoderma:** It produces Cyclosporin A that is used as an immunosuppressant agent in organ transplantation.

OR

Methanogens are the bacteria which grow anaerobically on cellulosic material and produce large amount of methane along with CO<sub>2</sub> and H<sub>2</sub>S.

(i) Present in cattle (rumen) a part of stomach.

(ii) They help in:

(a) Breaking down of cellulose present in food of cattle.

(b) Nutrition of animal for digestion of cellulose. The excreta of cattle is rich in these bacteria (methanogens) and therefore can be used for generation of biogas.

18. Rearrange the following in the correct sequence to accomplish an important biotechnological reaction:

(a) In vitro synthesis of copies of DNA of interest

(b) Chemically synthesized oligonucleotide

(c) Enzyme DNA-polymerase

(d) Complementary region of DNA

(e) Genomic DNA template

(f) Nucleotides provided

(g) Primers

(h) Thermostable DNA-polymerase (from *Thermus aquaticus*)

(i) Denaturation of ds-DNA 3

**Ans.** Correct sequence is

$i \rightarrow e \rightarrow b/g \rightarrow g/b \rightarrow c/h \rightarrow h/c \rightarrow f \rightarrow d \rightarrow a$   
 $\underbrace{\hspace{1.5cm}}_{=1} \quad \underbrace{\hspace{1.5cm}}_{=1} \quad \underbrace{\hspace{1.5cm}}_{=1}$

$a \rightarrow i \rightarrow e \rightarrow b/g \rightarrow g/b \rightarrow c/h \rightarrow h/c \rightarrow f \rightarrow d$   
 $\underbrace{\hspace{1.5cm}}_{=1} \quad \underbrace{\hspace{1.5cm}}_{=1} \quad \underbrace{\hspace{1.5cm}}_{=1}$

**Note:** (Stop Marking where the sequence goes wrong)

19. Describe any three potential applications of genetically modified plants. 3

**Ans.** More tolerant to abiotic stress, less dependence on chemical pesticides, reduces post harvest losses, increase efficiency of mineral usage by plants, enhance nutritional value of food. eg. Vitamin A enriched rice (Any three)

20. How did an American company, Eli Lilly use the knowledge of r-DNA technology to produce human insulin? 3

**Ans.** Two chains of DNA sequence corresponding to A & B chains of human insulin prepared, introduced them into plasmids of *E. coli* to produce separate A & B chains, A & B chains extracted combined by creating disulphide bonds 1×3

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

In 1983, Eli Lilly company prepared two DNA sequences corresponding to A and B chains of human insulin and introduced them in plasmids of *E. coli* to produce insulin chains. Chains A and B were produced separately, extracted and combined by creating disulphide bonds to form human insulin. Thus, the company used knowledge of recombinant DNA technology to prepare the insulin.

\* 21. How do snails, seeds, bears, zooplanktons, fungi and bacteria adapt to condition unfavourable for their survival? 3

\* 22. With help of a flow chart, show the phenomenon of biomagnifications of DDT in an aquatic food chain. 3

## SECTION - D

*Q No. 23 is of four mark*

23. Your School has been selected by the Department of Education to Organize and host an interschool seminar on "Reproductive Health-Problems and Practices". However, many parents are reluctant to permit their wards to attend it. Their argument is that the topic is "too embarrassing".

Put forth four arguments with appropriate reasons and explanation to justify the topic to be very essential and timely. 4

**Ans.** (i) The issue of puberty and adolescence need to be addressed effectively with the respective age group because many changes take place in the body during adolescence of which they are supposed to be aware of

(ii) To bring in awareness about their reproductive health and its effect on their physical, emotional and social being

(iii) To address the increase in sex abuse and sex crimes in our country

(iv) Myths and misconceptions related to reproductive issues

**Note:** (any other related or relevant argument with reasons may be accepted)



**SECTION - E**

*Q Nos. 24-26 are of five marks each*

24. (a) Plan an experiment and prepare a flow chart of the steps that you would follow to ensure that the seeds are formed only from the desired sets of pollen grains. Name the type of experiment that you carried out.

(b) Write the importance of such experiments. 5

OR

Describe the roles of pituitary and ovarian hormones during the menstrual cycle in a human female. 5

Ans. (a) Selection of flowers from desired plants → emasculatation → bagging → dusting of the pollens on the stigma of the flowers that were bagged → flower rebagged → fruit formed  $\frac{1}{2} \times 6 = 3$   
Artificial Hybridisation 1

(b) Production of superior/ improved varieties of plants. 1

OR

**Pituitary hormones:**

(When levels of FSH is high) FSH, induces follicular growth, secretion of estrogen by follicles, (when LH surge is there in the mid of the cycle) lutinising hormones/LH, along with FSH leads to ovulation, and then formation of corpus luteum.  $\frac{1}{2} \times 6$

**Ovarian hormone:**

Estrogen, repair/proliferation of endometrium, Progesterone, maintains endometrium for implantation  $\frac{1}{2} \times 4$   
(Low level of progesterone leads to menstrual flow)

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

The roles of pituitary and ovarian hormones during the menstrual cycle in a human female:

Hormone	Function
GnRH released by hypothalamus	Regulates the release of FSH and LH (gonadotropins) from anterior pituitary.
FSH from anterior pituitary	Stimulates the formation of Graafian follicle from primordial follicle. It also stimulates GF to secrete oestrogen.
Oestrogen from ovary	Oestrogen repairs the endometrial lining. High oestrogen stimulates LH and cuts off FSH.
LH from anterior pituitary	LH surge causes ovulation. LH favours conversion of GF to corpus luteum. LH causes secretion of progesterone from corpus luteum.

Progesterone from ovary/ Corpus luteum	Progesterone makes endometrial lining soft/spongy/thick and vascular. Progesterone inhibits LH production.
--	--

25. (a) Why are thalassaemia and haemophilia categorized as Mendelian disorders? Write the symptoms of these diseases .Explain their pattern of inheritance in humans.

(b) Write the genotypes of the normal parents producing a hemophilic son. 5

OR

How do m-RNA, t-RNA and ribosomes help in the process of translation? 5

Ans. (a) Both are caused due to alteration/mutation, in a single gene and follow Mendelian pattern of inheritance  $\frac{1}{2} \times 2$

**Symptoms:**

thalassaemia-anaemia (caused due to defective/ abnormal Hb), haemophilia -non stop bleeding even in minor injury.  $\frac{1}{2} \times 2$

**Pattern of inheritance:**

thalassaemia autosomal recessive inheritance pattern, inherited from heterozygous/parent carrier  $\frac{1}{2} \times 2$

haemophilia-X linked recessive inheritance, inherited from a haemophilic father/carrier mother (females are rarely haemophilic)  $\frac{1}{2} \times 2$

(b) Xh X-Mother  $\frac{1}{2}$   
XY-Father  $\frac{1}{2}$

OR

mRNA provides a template, with codons for specific amino acids to be linked to form a polypeptide/ protein  $\frac{1}{2} + \frac{1}{2}$

tRNA brings amino acid to the ribosomes, reads the genetic code with the help of its anti-codons, initiator tRNA is responsible for starting polypeptide formation in the ribosomes, tRNAs are specific for each amino acid  $\frac{1}{2} \times 4$

Ribosomes-(Cellular factories for proteins synthesis) its smaller sub unit binds with mRNA to initiate protein synthesis at the start codon/AUG, in its larger sub unit there are two sites present which brings two amino acids close to each other helping them to form peptide bond, ribosomes moves from codon to codon along mRNA, amino acids are added one by one to form polypeptide/ protein  $\frac{1}{2} \times 4$

[CBSE Marking Scheme, 2015]

26. (a) List the different attributes that a population has and not an individual organism.

(b) What is population density? Explain any three different ways the population density can be measured, with the help of an example each. 5

OR

"It is often said that the pyramid of energy is always upright. On the other hand, the pyramid of biomass can be both upright and inverted." Explain with the help of examples and sketches. 5

**Ans (a) Attributes of population:**

Birth rate, Death Rate, sex ratio, age pyramids/age distribution. (Any two)  $\frac{1}{2} \times 2$

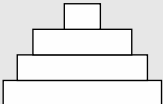
**(b) Population density:**

Number of individuals per unit area at a given time / period. 1

- (1) Biomass / % Cover, e.g Hundred Parthenium plants and 1 huge banyan tree.  $\frac{1}{2} \times 2$
- (2) Relative Density, e.g Number of fish caught per trap from a lake.  $\frac{1}{2} \times 2$
- (3) Numbers, e.g Human population.  $\frac{1}{2} \times 2$
- (4) Indirect estimation, e.g without actually counting/seeing them e.g tiger census based on pugmarks and fecal pellets.

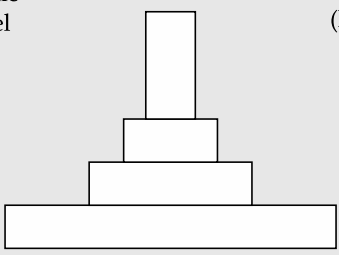
(Any three)  $\frac{1}{2} \times 2$

OR

TC (Tertiary consumer)		10J (10% available)
SC (Tertiary consumer)		100J (10% available)
PC (Primary consumer)		1000J (10% available)

**Upright Pyramid of Energy:** e.g of any Grassland food chain depicting energy transfer at each trophic level 1+1


Trophic Level	Dry weight (kg m <sup>-2</sup> )
TC	1.5
SC	11
PC	37
PP	809



**Upright Pyramid of Biomass:** e.g grassland food chain-grass rabbit fox Tiger

(Any other relevant example)  
1 for Diagram +  $\frac{1}{2}$  for example

**Note:** (If only two trophic levels are drawn with dry weight mentioned correctly can be accepted)

PC		21
PP		4

**Inverted Pyramid of Biomass:** e.g aquatic ecosystem where small standing crop of phytoplanktons supports large standing crop of zooplanktons 1 for Diagram +  $\frac{1}{2}$  for example [CBSE Marking Scheme, 2015]

**Outside Delhi Set II**

**Code No. 57/2**

**Note:** Except for the following questions, all the remaining questions have been asked in previous set.

**SECTION - A**

3. State the cause of adenosine deaminase enzyme deficiency. 1

**Ans.** Deletion of gene for adenosine deaminase.

**SECTION - B**

8. Explain the process of secondary treatment given to the primary effluent up to the point it shows significant change in the level of biological oxygen demand (BOD) in it. 2

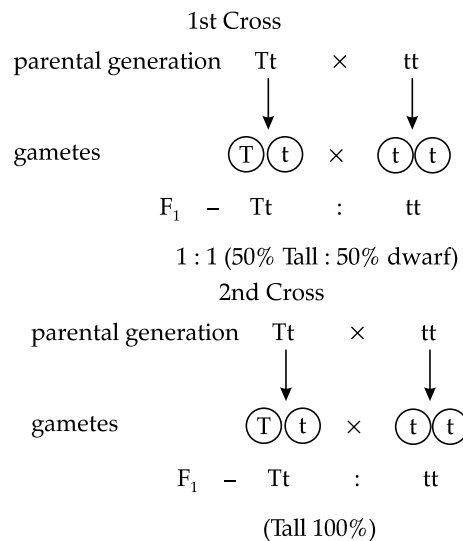
**Ans.** The primary effluent is passed into large aeration tanks where it is constantly agitated, mechanically pumping air into it, this allows vigorous growth of useful aerobic microbes into flocs, these microbes consumes the major part of organic matter in the effluent (this significantly reduces the BOD of the effluent)  $\frac{1}{2} \times 4 = 2$

**SECTION - C**

14. Two independent monohybrid crosses were carried out involving a tall pea plant with a dwarf pea plant. In the first cross, the offspring population had equal number of tall and dwarf plants,

whereas in the second cross it was different. Work out the crosses, and explain giving reasons for the difference in the offspring populations. 3

**Ans.**



**Reason:** In the first cross the tall parent plant is heterozygous for the trait, in second cross tall parent plant is homozygous for the trait.

19. Explain co-evolution with reference to parasites and their hosts. Mention any four special adaptive features evolved in parasites for their parasitic mode of life.

**Ans.** If the host evolves special mechanism for rejecting or resisting the parasite the parasite has to (simultaneously)evolve / co-evolve the mechanism to counter act and neutralise them. **1**

- (a) Parasitic adaptation in Animals:
- (i) Loss of (unnecessary) sense organs in animals
  - (ii) Presence of adhesive organs/suckers
  - (iii) Loss of digestive system
  - (iv) High reproductive capacity
  - (v) Resemblance of eggs in the case of brood parasitism  $\frac{1}{2} + \frac{1}{2} = 1$
- (b) Parasitic adaptation in plants
- (vi) Haustoria in Cuscuta
  - (vii) Loss of chlorophyll
  - (viii) Loss of leaves / foliage  $\frac{1}{2} + \frac{1}{2} = 1$

*Note: (Any four adaptations with correct reference Animal or Plant can be allotted marks)*

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

Co-evolution can be defined as reciprocal adaptations in two interacting organisms that brings about the evolutionary change in both of them.

**In terms of the relation of host and parasite, it can be explained as follows:**

Parasite is an organism that is totally dependent on the host organism for its survival, but in doing so, it also harms the host. The host evolved over a long period of time to protect itself from parasite, while parasite evolved so that it can find other way to derive nutrition from the host and hence, the cycle continues.

Parasites have evolved the following adaptations.

- (i) Loss of unnecessary sense organs.
- (ii) Presence of hook/adhesive organs and suckers
- (iii) Loss of digestive system.
- (iv) High reproductive capacity

**\* 21. With the help of a flow- chart exhibit the events of eutrophication.** **3**

**SECTION - E**

**26. (a) Why are colourblindness and thalassemia categorised as Mendelian disorders? Write the symptoms of these diseases seen in people suffering from them.**

**(b) About 8% of human male population suffers from colourblindness whereas only about 0.4% of human female population suffers from this disease. Write an explanation to show how it is possible.** **3**

**OR**

**Explain the process of transcription in prokaryotes. How is the process different in eukaryotes ?** **3**

**Ans. (a)** Both are caused due to mutation/alteration in a single gene, and follow Mendelian inheritance.

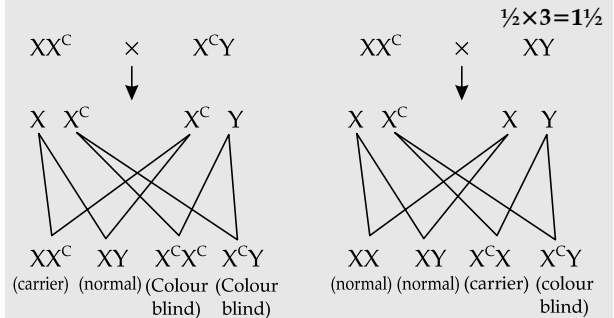
$\frac{1}{2} \times 2$

colour blindness -unable to discriminate between red and green colours **1**

thalassemia - (formation of abnormal haemoglobin resulting in) Anaemia **1**

**(b)** it is due to a recessive mutation in the X chromosomes  $\frac{1}{2}$

Males have only one X chromosome and females have two, female will be colour blind only in a homozygous recessive state/ both X chromosomes carry the defective gene/  $X^c X^c$ , whereas male will be colour blind if they are  $X^c Y$ / heterozygous.



**OR**

Initiation, DNA dependent RNA polymerase associates with the Initiation factor/ $\sigma$  factor, and binds to the promoter site of DNA thus initiates transcription.  $\frac{1}{2} \times 3 = 1\frac{1}{2}$

Elongation, The RNA polymerase using nucleoside triphosphates, polymerises in a template dependent fashion in 5' to 3' direction, following the rule of complimentarity.  $\frac{1}{2} \times 3 = 1\frac{1}{2}$

Termination, at the terminator region the enzyme associates with the rho ( $\rho$ ) and both the enzymes and the newly formed/nascent RNA fall off from the DNA  $\frac{1}{2} \times 2 = 1$

**Note: (Self Explanatory diagrams with correct labelling may be accepted)**

**Difference:**

(i) There are 3 different types of RNA polymerases in the nucleus of eukaryotes (polymerising the three different types of RNA molecules) but only 1 in prokaryotes

(ii) Primary transcripts (hnRNA/precursor mRNA) undergoes splicing capping and tailing to give rise to functional RNA/mRNA (that moves out of the nucleus) this processing is absent in prokaryotes.

$\frac{1}{2} \times 2 = 1$

[CBSE Marking Scheme, 2015]

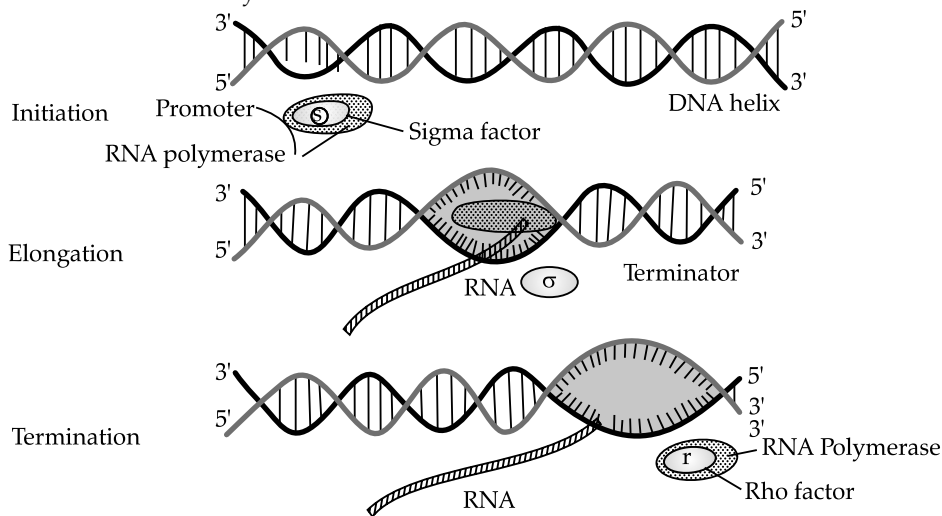
Detailed Answer:

OR

**The mechanism of transcription in prokaryotic cell:**

The process of transcription is completed in three steps: Initiation, elongation and termination.

(a) **Initiation:** The enzyme binds at the promoter site of DNA and initiates the process of transcription. It causes the local unwinding of the DNA double helix. In initiation, sigma factor ( $\sigma$ ) present in RNA polymerase initiates the RNA synthesis.



Process of Transcription in Prokaryotes

The difference between the process of transcription in prokaryotes and eukaryotes:

[Same as given in CBSE Marking Scheme]

**Outside Delhi Set III**

**Code No. 57/3**

**Note:** Except for the following questions, all the remaining questions have been asked in previous set.

**SECTION - A**

5. Suggest any two possible treatments that can be given to a patient exhibiting adenosine deaminase deficiency. 1

**Ans. (i)** Enzymes replacement therapy ( in which functional ADA is injected)  
**(ii)** Bone marrow transplantation  
**(iii)** Gene therapy / Culturing the lymphocytes followed by introduction of functional ADA cDNA into it & returning it into the patient's body.  
 (Any two)<sup>1/2+1/2</sup>  
 [CBSE Marking Scheme, 2015]

Detailed answer:

(a) Adenosine deaminase (ADA) enzyme is crucial for the immune system to function. The disorder is caused due to the deletion of the gene for adenosine deaminase. If the functional gene isolated from bone marrow cells producing ADA is introduced

(b) **Elongation:** The RNA chain is synthesized in the 5' → 3' direction. RNA polymerase uses nucleoside triphosphate as substrate and polymerisation occurs according to complementarity.

(c) **Termination:** Termination occurs when the termination factor (rho) alters the specificity of RNA polymerase to terminate the transcription. As the RNA polymerase proceeds to perform elongation, a short stretch of RNA remains bound to the enzyme. As the enzyme reaches the termination region, this nascent RNA falls off and transcription is terminated.

into cells at early embryonic stages, it could be a permanent cure.

(b) In gene therapy, lymphocytes are taken from the patient's bone marrow and the normal gene for ADA is introduced into the lymphocytes using retrovirus. These cells are re-introduced in the patient's immune system. As these cells are not immortal, the patient requires a periodic infusion of such genetically engineered lymphocytes. Hence, it is not a permanent cure.

**SECTION - B**

6. Select two pairs from the following which exhibit divergent evolution. Give reasons for your answer.

- (i) Forelimbs of cheetah and mammals
- (ii) Flippers of dolphins and penguins
- (iii) Wings of butterflies and birds
- (iv) Forelimbs of whales and mammals 2

**Ans. (i) and (iv)** 1/2+1/2  
 Having similar anatomical structure / origin, but performing different functions 1/2+1/2  
 [CBSE Marking Scheme, 2015]

**Detailed Answer:**

- (i) Forelimbs of cheetah and mammals and (iv) Forelimbs of whales and mammals exhibit divergent evolution.

**Reason:** When the same structure in different animals, develops along different directions due to adaptations to different needs, the condition is called as divergent evolution. The forelimbs of mammals like Whales, Bats, Cheetahs and humans share similarities in the pattern of bones - all of them have humerus, radius, ulna, carpals, metacarpals and phalanges in their forelimbs. Though these forelimbs perform different functions in these animals.

- \* 7. A liverwort plant is unable to complete its life-cycle in a dry environment. State two reasons. 2

10. Explain the function of "anaerobic sludge digester" in a sewage treatment plant. 2

**Ans.** Anaerobic sludge digester has anaerobic bacteria that digests the aerobic bacteria and fungi present in the sludge during the digestion these bacteria produce mixture of gases such as methane and H<sub>2</sub>S and CO<sub>2</sub> / biogas

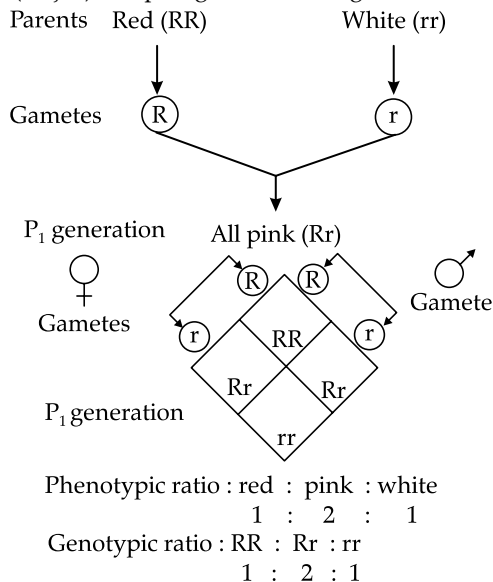
**Detailed Answer:**

In an aerobic sludge digester, the anaerobic bacteria-methanogen, digest the flocs of bacteria and fungi in activated sludge and produce methane along with H<sub>2</sub>S and CO<sub>2</sub> i.e. biogas which is a source of energy as it is inflammable.

**SECTION - C**

11. The F<sub>2</sub> progeny of a monohybrid cross showed phenotypic and genotypic ratio as 1 : 2 : 1, unlike that of Mendel's monohybrid F<sub>2</sub> ratio. With the help of suitable example, work out a cross and explain how it is possible. 3

**Ans.** *Mirabilis jalapa* / four O' clock plant / *Antirrhinum* (majus) / Snapdragon flower / dog flower



In heterozygous condition a single dominant gene is not sufficient to produce red colour, therefore it is a case of incomplete dominance.

12. Why are some seeds referred to as apomictic seeds? Mention one advantage and one disadvantage to a farmer who uses them. 3

**Ans.** Seeds produced without fertilisation are referred to as apomictic 1

**Advantage:** Desired characters retained in offspring (progeny) / no segregation of characters in offspring (progeny) / assured seed production in absence of pollinators 1 (Any other relevant advantage)

**Disadvantage:** Cannot control accumulation of deleterious genetic mutation / usually restricted to narrow ecological niches / lack ability to adapt to changing environment

1 (Any other relevant disadvantage)  
[CBSE Marking Scheme, 2015]

**Detailed Answer:**

The seeds which are formed without the fusion of gametes are called apomictic seeds. In such seeds, diploid cells of the nucellus or integuments develop into an embryo, giving diploid seeds with a genetic constitution identical to the parent.

**Advantages:** apomictic seeds are effective means of rapid production of pure lines and provides an easy way of hybrid seed production.

**Disadvantage:** It reduces genetic diversity from parent to offspring plants due to a lack of variations in asexual reproduction.

14. "A very small sample of tissue or even a drop of blood can help to determine paternity".

Provide a scientific explanation to substantiate the statement. 3

**Ans. (i)** DNA from all cells of an individual shows the same degree of polymorphism and therefore becomes a useful identification tool 1

**(ii)** Polymorphs are heritable and the child inherits 50% of the chromosome from each parent 1

**(iii)** With the help of PCR the small amount of DNA from blood can be amplified and be used in DNA finger printing to identify the paternity 1

**Note:** (if only DNA finger printing is described or illustrated allot only 1 mark)

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

DNA fingerprinting is the basis of paternity testing. This process requires isolation of DNA from any cells of tissue or a drop of blood to make copies of DNA by polymerase chain reaction (PCR). DNA fingerprinting involves identifying differences in some specific regions in DNA sequence called as respective DNA, because in these sequences, a small stretch of DNA is repeated many times. These

sequences normally do not code for any proteins, but they form a large portion of human genome. These sequence show high degree of polymorphism and form the basis of DNA fingerprinting. As the polymorphisms are inheritable from parents to children.

**SECTION - E**

*Q. Nos. 24 is of five marks each*

24. (a) How are Mendelian inheritance, polygenic inheritance and pleiotropy different from each other ?

(b) Explain polygenic inheritance pattern with help of suitable example. 5

OR

(a) Draw a labelled diagram of a "replicating fork" showing the polarity. Why does DNA replication occur within such 'fork' ?

(b) Name two enzymes involved in the process of DNA replication, along with their properties. 5

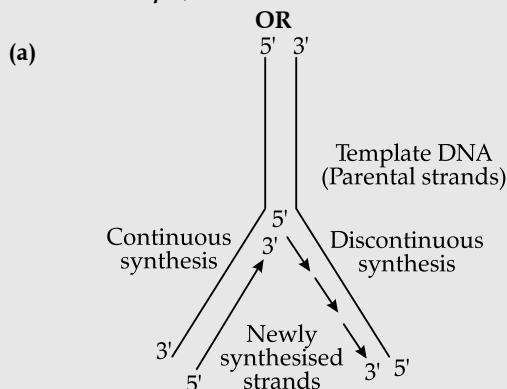
Ans. (a)

Mendelian Inheritance	Polygenic inheritance	Pleiotropy
One gene controls one trait/character/phenotype	Two or more genes influence the expression of one trait/character/phenotype	One gene controls the expression of more than one trait/character/phenotype

1×3

(b) Human Height/skin colour are examples of polygenic inheritance, height trait is controlled by at least three gene pairs, additive effect of each allele contributes to the phenotypic expression of the trait, more the dominant alleles more pronounced is the phenotypic expression / more the recessive alleles less pronounced is the phenotypic expression.  $\frac{1}{2} \times 4 = 2$

**Note:** (skin colour may be accepted in place of height as an example)



(Correct diagram with polarity of parental strands and any other 3 labels)  $\frac{1}{2} \times 4$

Since two strands of DNA cannot be separated in its entire length due to very high energy requirement / high amount of energy is required to break the hydrogen bonds holding the two strands the replication occurs in small opening of DNA strands called the Replication fork. 1

(b) (i) DNA dependent DNA polymerase, adds nucleotides only in 5' to 3' directions/are very fast.  $\frac{1}{2} \times 2 = 1$

(ii) DNA ligase, joins the discontinuously synthesised DNA fragments during replication.  $\frac{1}{2} \times 2 = 1$

[CBSE Marking Scheme, 2015]

**Detailed Answer:**

(a) Mendelian inheritance refers to the expression of monogenic traits, i.e. gene expression is controlled by one gene. In a pair of alleles, an expression of the recessive gene is always masked by the expression of a dominant gene.

Pleiotropy is the ability of a gene to have multiple phenotypic effects because it influences several characters simultaneously.

Polygenic inheritance, on the other hand is a type of inheritance controlled by one or more genes in which the dominant alleles have a cumulative effect with each dominant allele expressing a part or unit of the trait, the full being shown only when all the dominant alleles are present.

(b) Polygenic inheritance is the inheritance of traits that are produced by the combined effect of many genes. A polygenic trait is controlled by more than one pair of non-allelic genes and shows different types of phenotypes. For example, human skin colour is an example of polygenic inheritance. It is caused by a pigment called melanin due to three pairs of polygenes (A, B and C).

OR

(b) (i) DNA polymerase enzyme is responsible for synthesizing DNA, they add nucleotides one by one to the growing DNA chain, adding those which are complementary to the template. The template strand has polarity in 3' → 5' because the RNA-polymerase can polymerize RNA only in 5' - 3' direction.

(ii) The DNA ligase enzyme joins or seals the discontinuous fragments of DNA. It helps in joining the DNA strands together by catalysing the formation of the phosphodiester bond. It also plays an important role in repairing the single-strand break in the DNA duplex. It also plays an important role in joining the discontinuously synthesized fragments of the lagging strand (Okazaki fragments) of DNA.